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# Pyrolysed carbon microelectrodes with improved performance for cyclic voltammetry and EIS

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Conductive carbon structures can be obtained from a polymer template through a pyrolysis process. These structures can be used for example as electrodes or scaffolds. One possible application of the microelectrodes could be integration in a measurement setup with microfluidic and electronic components to study the toxicity of heavy metals and hormones in water. This study focuses on the optimization of 2D pyrolysed carbon microelectrodes obtained from a lithographic process to improve performance for electrochemical characterization (Fig. 1.a). SU-8 was used as photoresist to create the polymer template on a Si-based carrier substrate, and then pyrolysed at 900°C. Different electrodes were fabricated, focusing on the optimization of the fabrication process to decrease impedance, parasitic effects and improve performance in cyclic voltammetry (CV). A gold pseudo-reference electrode and gold contact pads were deposited by e-beam evaporation through a shadow mask, and a 5µm thick film of SU-8 was used as passivation layer. Electrochemical analysis was performed using CV and impedance spectroscopy both in PBS and in ferri-ferrocyanide using a self-aligning magnetic clamping system (Fig. 1.b). By increasing the carbon thickness, the peak current increased, the ΔEp decreased (Fig. 1.c), and the measured impedance at high frequencies was reduced (Fig. 1.d). The optimal final thickness of the pyrolysed carbon was 2.2 µm with a sheet resistance of 81.1 Ω/sq.

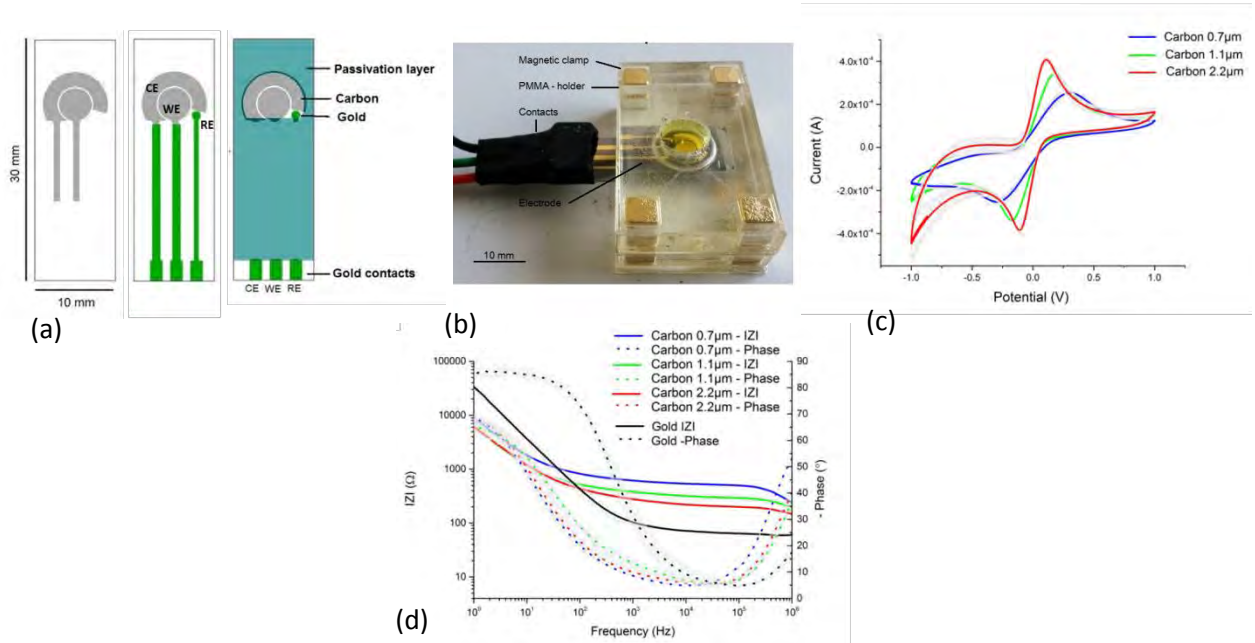


Figure 1: Top view of the microelectrodes composed of a circular carbon working electrode (WE), surrounded by a carbon counter electrode (CE), gold reference (RE), and passivation layer (SU8) (a), self-aligning magnetic clamping system for electrochemical analysis (b), CV spectra in ferri-ferrocyanide (c) and impedance spectra in PBS (d) of the optimized electrode with long gold leads and increased carbon thickness